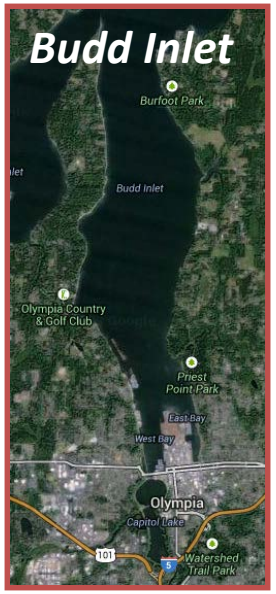
Dissolved oxygen impacts in Budd Inlet, South Puget Sound, and the Salish Sea

Briefing for EPA – 9/26/13



Mindy Roberts, Anise Ahmed, and Greg Pelletier

(Department of Ecology, Environmental Assessment Program)

Salish Sea includes Puget Sound, Strait of Juan de Fuca, and the Georgia Strait, including Canada

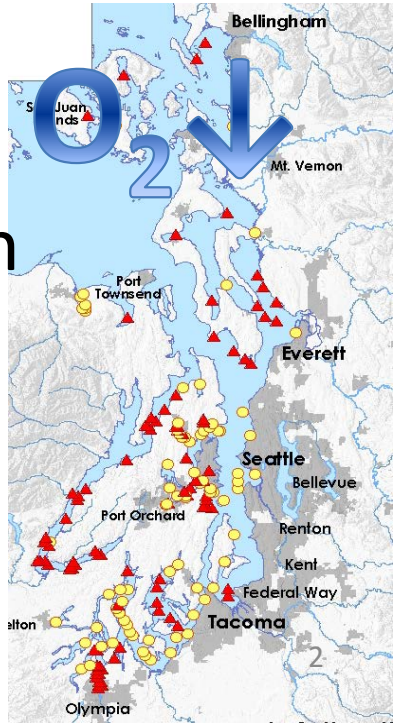
How are oxygen and nitrogen related?

- Human activities add nitrogen through wastewater, manure, fertilizer, etc.
- Nitrogen fuels algae blooms in Puget Sound
- As algae decomposes, it draws down oxygen
- Fish, and other aquatic life, need oxygen to breathe

➢ Same questions as in Chesapeake Bay, Long Island Sound, Gulf of Mexico

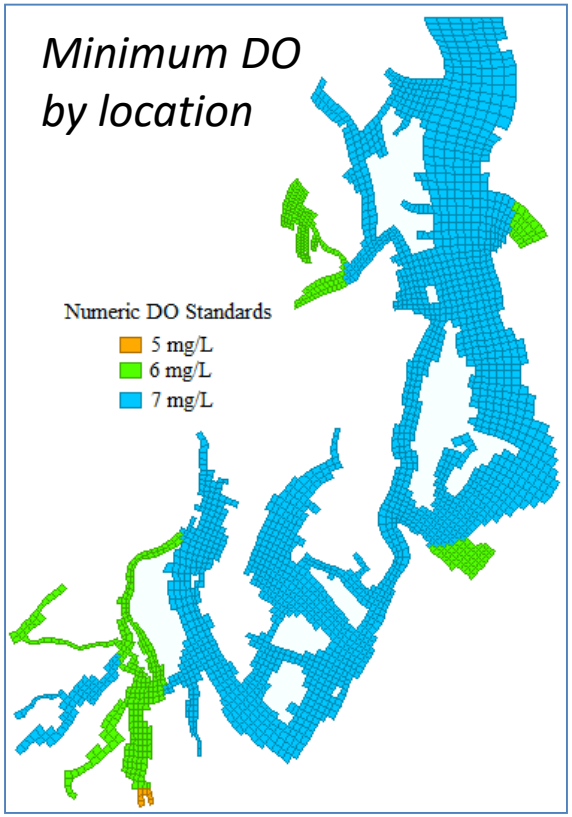
+N

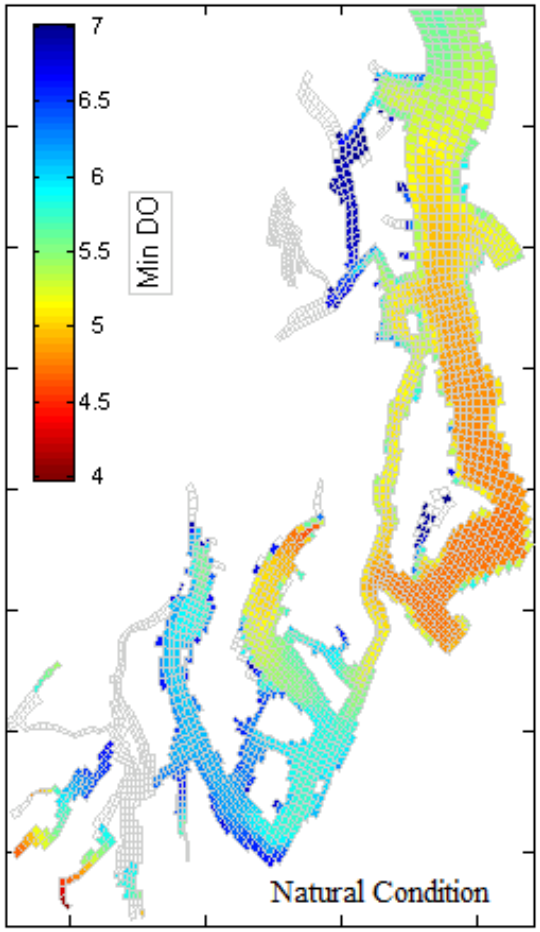
→algae



How do the Water Quality Standards for oxygen (DO) work in Puget Sound?

- Oxygen > 7 mg/L (varies by location)



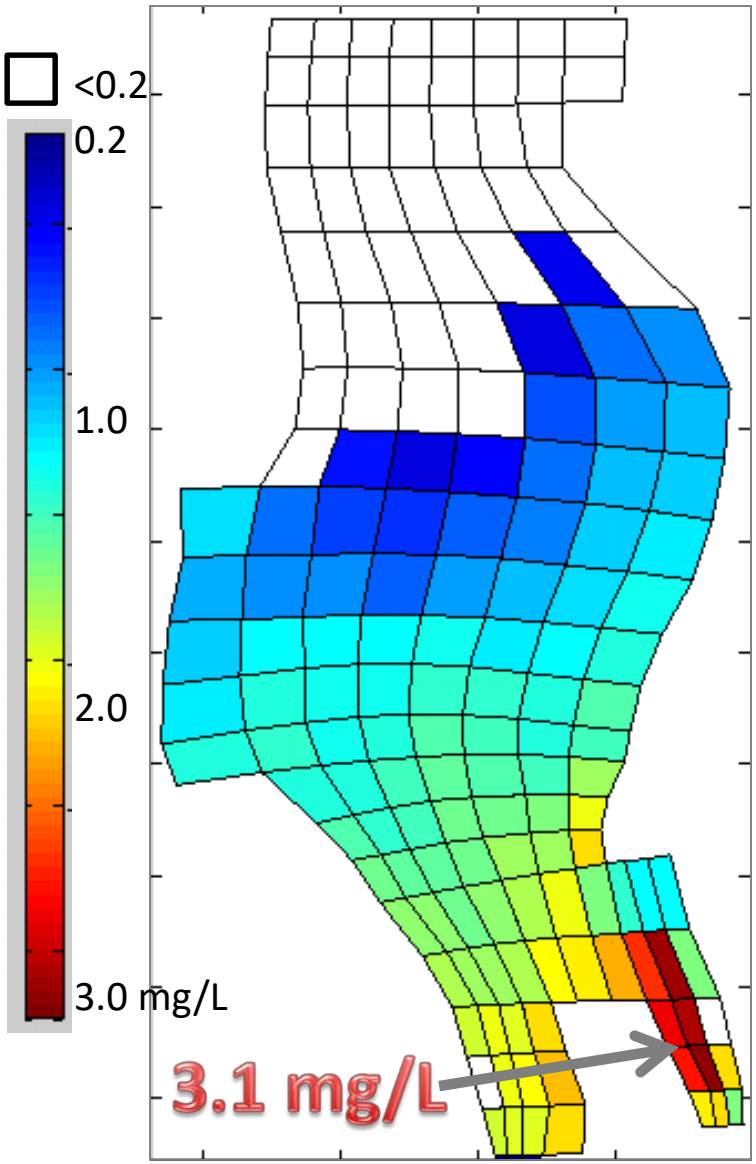


- If naturally < 7 mg/L, total human impact cannot cause oxygen to decline more than **0.2 mg/L**

What are the key questions for Ecology?

- How much is natural and how much is human?
  - *Need sophisticated computer models to distinguish*
- How much reduction is needed to meet water quality standards?
- Are permit changes needed to meet water-quality based effluent limits?

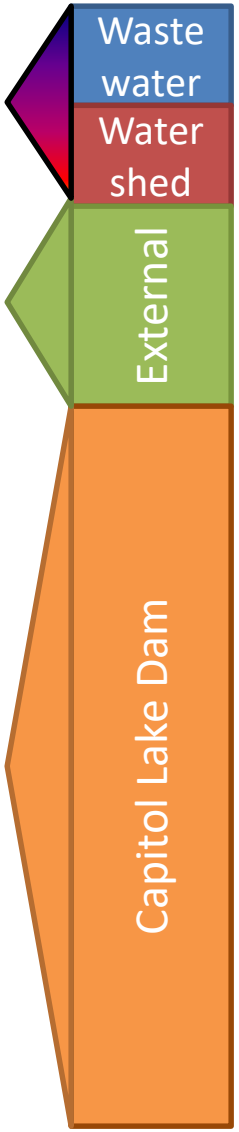
Budd Inlet findings: Human activities cause dissolved oxygen to decline as much as 3 mg/L below natural



Local sources need reductions

External sources need reductions

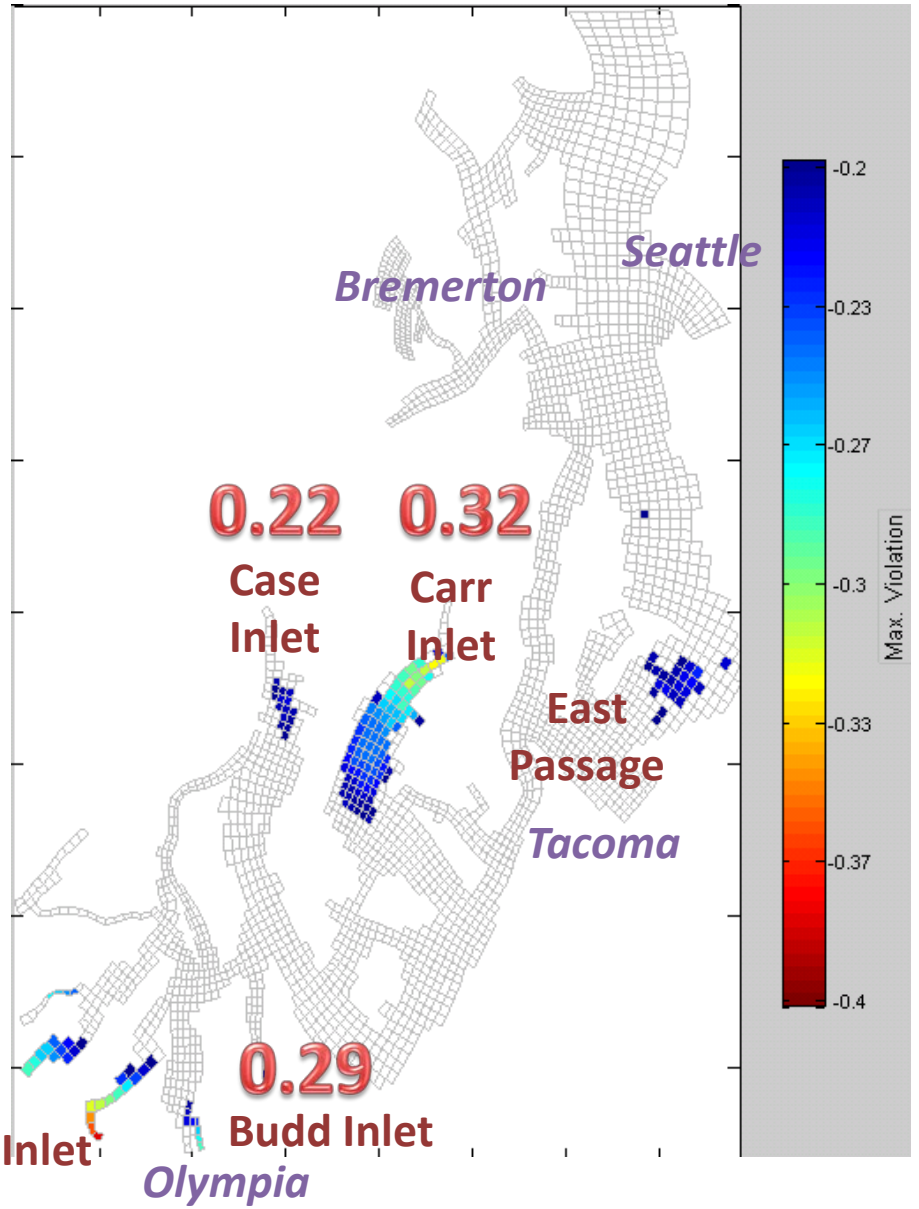
Capitol Lake dam has the largest impact on Budd Inlet oxygen and needs reduction



Ecology TMDL funds

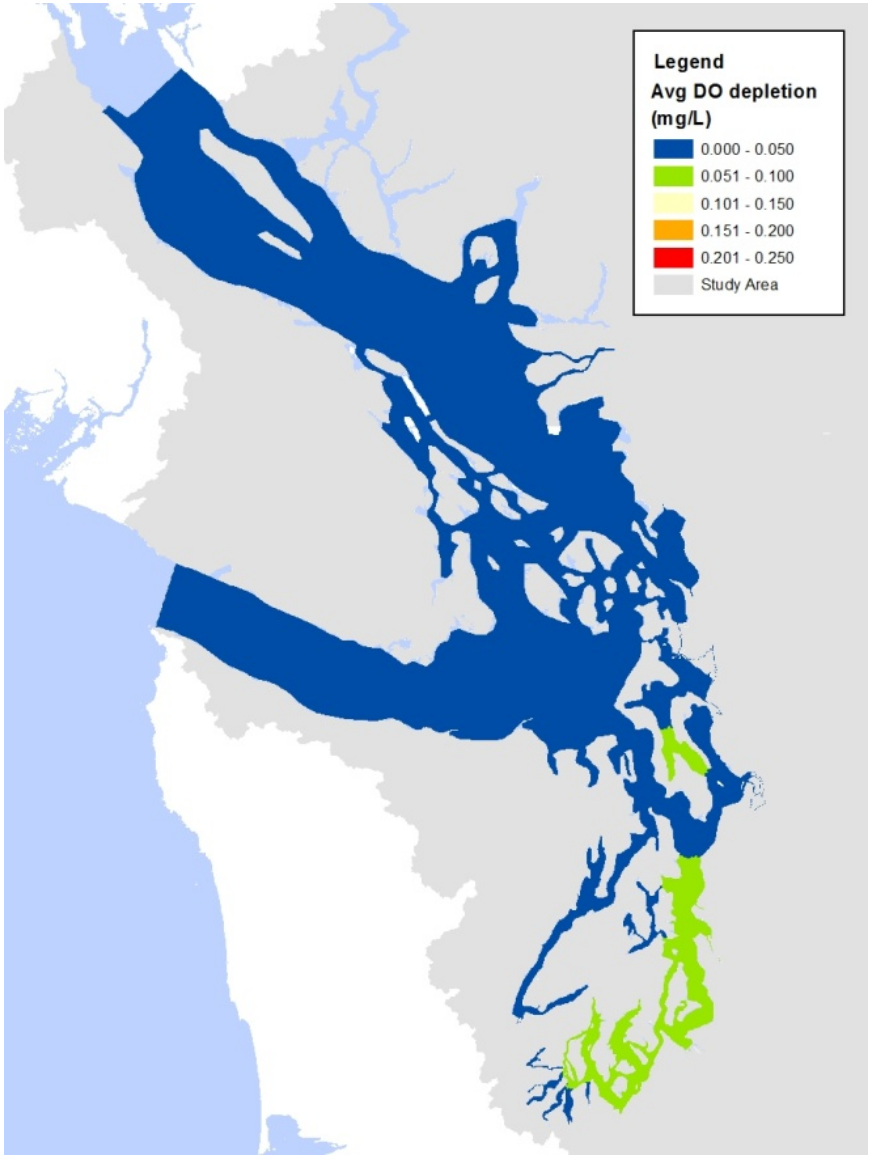
South (and Central) Puget Sound findings: Current human sources cause oxygen to decline as much as 0.4 mg/L

- Wastewater discharges to marine waters have bigger influence than river sources
- South Sound depletions influenced by a combination of:
  - South Sound sources
  - Central Sound sources
  - Other external human sources (North Sound and beyond?)



Ecology + EPA funds

Salish Sea findings: Current human sources cause oxygen to decline as much as 0.1 mg/L



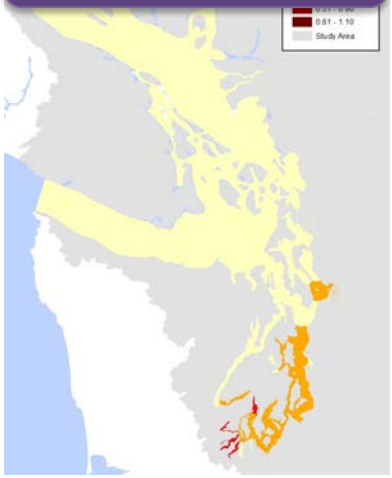
- Wastewater discharges to marine waters have bigger influence than river sources
- South and Central Puget Sound reflect greatest impact from human sources

EPA grant from NEP to ECY + PNNL + Ecology funds

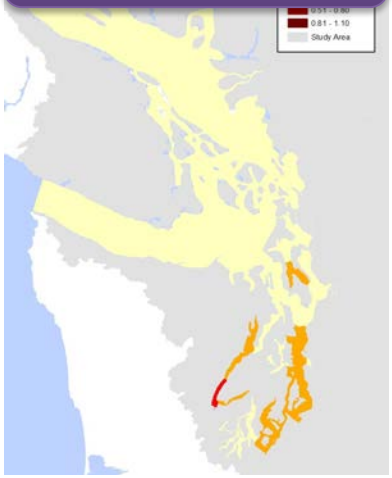
Salish Sea findings: Future population growth will increase oxygen impacts; ocean makes it even worse

Current human sources, circulation, ocean conditions, air temperature

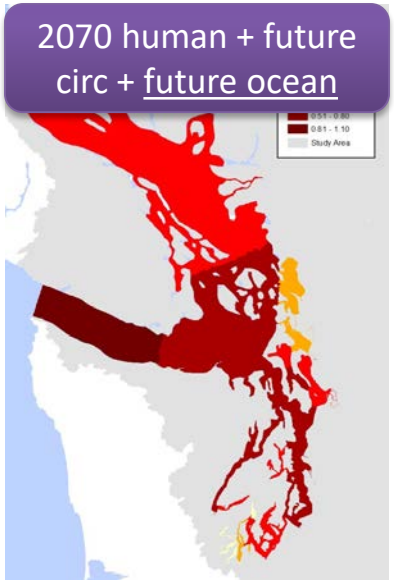
2070 human



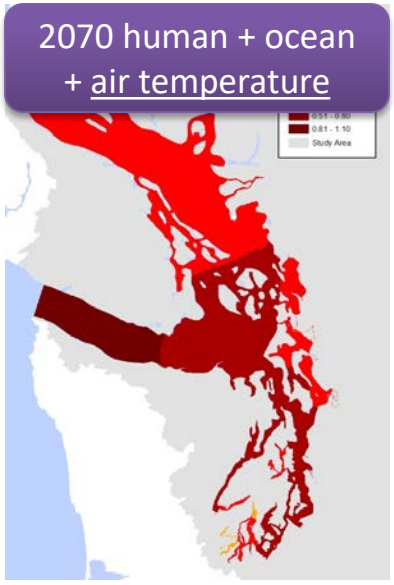
2070 human + future circulation



2070 human + future circ + future ocean



2070 human + ocean + air temperature



LEGEND

(mg/L of oxygen decline compared with current conditions)

- 0.00 - 0.10
- 0.11 - 0.20
- 0.21 - 0.50
- 0.51 - 0.80
- 0.81 - 1.10

Uncertainties

- Inherent model error
  - Similar to other models used to regulate sources
  - Unknowns including climate change and ocean boundary changes
- Future sediment enrichment
  - Model currently has no sediment “model”
  - DO is sensitive to sediment assumptions
  - Our current assumptions are conservative
  - Next phase is to improve enrichment prediction

Key findings

- Ocean conditions are dominant
- Human impacts are achieving water quality standards in many areas today
- Portions of South and Central Puget Sound are just over the standards today
  - Model uncertainty
  - Standards could face scrutiny
- Budd Inlet impacts must be reduced to meet standards

Key messages

- Actions are needed to help Budd Inlet meet standards
- Wastewater discharges are at or approaching levels of regulatory concern in South and Central Puget Sound now and will increase with population
- We do not have enough scientific certainty for immediate regulatory action
- We recommend additional analyses of both models
- When impacts are close to 0.2 mg/L, standards could face scrutiny

Project next steps

- ➢ *We invite interested parties to work with us to improve the models*
- Budd Inlet:
  - WQP continuing with Deschutes River TMDL
  - Unclear path for Capitol Lake and Budd Inlet TMDL components
- South/Central Puget Sound and Salish Sea:
  - External review draft reports (separate) distributed September 30
  - Joint advisory committee meeting week of October 7
  - Finalize reports in December, January
  - 2014-15 – refine Salish Sea model
  - Use refined Salish Sea models to inform regulatory decisions